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Building & Highway Material Testing Laboratory

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Job No.: CTCE/BBMP/W.No.07/KRIDL/WMM/Shape.T/2014-15 : 30.06.2014

DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Client	: **Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	: **Technical Manager (West),** KRIDL, Bangalore.
Name of Work	: Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	: AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Technical Reference	: IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	: Wet Mix Macadam
Date of Testing	: 30.06.2014

Result : Flakiness Index = **12.35%**

Elongation Index = **13.46%**

Result : Combined Flakiness & Elongation index **25.81%**

Comments:

Maximum allowable Flakiness & Elongation Index for Wet Mix Macadam is 30%

Note:

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DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Client	: **Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	: **Technical Manager (West),** KRIDL, Bangalore.
Name of Work	: Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	: AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Technical Reference	: IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	: Wet Mix Macadam
Date of Testing	: 30.06.2014

Result : Flakiness Index = **11.24%**

Elongation Index = **13.53%**

Result : Combined Flakiness & Elongation index **24.77%**

Comments:

Maximum allowable Flakiness & Elongation Index for Wet Mix Macadam is 30%

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DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Client	: **Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	: **Technical Manager (West),** KRIDL, Bangalore.
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Reference	: AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Technical Reference	: IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	: Wet Mix Macadam
Date of Testing	: 30.06.2014

Civil-Tech Consultants & Engineers Bangalore

Result : Flakiness Index = **11.74%**

Elongation Index = **13.62%**

Result : Combined Flakiness & Elongation index **25.36%**

Comments:

Maximum allowable Flakiness & Elongation Index for Wet Mix Macadam is 30%

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Client	: **Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
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Reference	: AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Technical Reference	: IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	: Wet Mix Macadam
Date of Testing	: 30.06.2014

Result : Flakiness Index = **11.86%**

Elongation Index = **13.91%**

Result : Combined Flakiness & Elongation index **25.77%**

Comments:

Maximum allowable Flakiness & Elongation Index for Wet Mix Macadam is 30%

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Job No.: CTCE/BBMP/W.No.07/KRIDL/WMM/AL/2014-15 30.06.2014

ATTERBERG LIMITS TEST FOR WMM
MORTH TABLE-400-11

Client : **Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.

Agency : **Technical Manager (West),** KRIDL, Bangalore.

Name of Work : Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.

Reference : AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014

Date of Testing : 30.06.2014

Material : WMM

Sample Location : WMM Mix Plant

As per MORTH Table 400-11

Sl. No.	Particulars	Test Results	Standards as per Specifications
1	Liquid Limit, %	22.60	25.0% Maximum.
2	Plasticity Index, %	Non Plastic	6.0% Maximum.

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Job No.: CTCE/BBMP/W.No.07/KRIDL/QB/2014-15 14.07.2014

TEST REPORT

Client	:	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	:	**Technical Manager (West),** KRIDL, Bangalore.
Name of the work	:	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	:	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Source of location	:	Hot mix Plant, Bangalore
Date of testing	:	14.07.2014

The results of the tests conducted on the bitumen sample using for Dense Graded Bituminous Macadam

Sl. No	Description	Test Result	Requirement as per IS:73:2006
1	Penetration at 25 ^{0}C, 1/10 mm	85	80 to 100
2	Softening point, ^{0}C	51	Min. 40
3	Ductility at 27^{0}C, cm	100 >	Min. 75
4	Flash Point, ^{0}C	380	Min. 220

Note:

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Job No: CTCE/BBMP/W.No.07/KRIDL/SDBC(QB)/2014-15 21.07.2014

TEST REPORT

CLIENT	:	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
AGENCY	:	**Technical Manager (West),** KRIDL, Bangalore.
NAME OF THE WORK	:	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
REFERENCE	:	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
SAMPLE ID	:	Bitumen
DAT OF TESTING	:	21.07.2014

The results of the tests conducted on the bitumen sample using for Semi Dense Bituminous Concrete.

Sl. No	Description	Test Method as per IS	Test Result	Requirement as per IS:73:2013
1	Penetration at 25 °C, 1/10 mm	IS :1203 -1978 (RA-2009)	89	80 to 100
2	Softening point, °C	IS :1205 -1978 (RA-2009)	46	Min. 40
3	Ductility at 27°C, cm	IS :1208 -1978 (RA-2009)	100 >	Min. 75
4	Flash Point, °C	IS :1209 -1978 (RA-2009)	292	Min. 220

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/AIV/2014-15 21.07.2014

Aggregate Impact Value

IS: 2386 Part IV

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of the Work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Source / Location	Hot Mix Plant, Bangalore
Type of Mix	Semi Dense Bituminous Concrete
Date of Testing	21.07.2014

Sl No.	Details	Trial No. 1	Trial No. 2	Average
1	Total weight of aggregate sample filling the cylindrical measure = W_1 g	386	388	
2	Weight of agregate passing 2.36 mm sieve after the test = W_2 g	85	89	
3	Weight of aggregate retained 2.36 mm sieve after the test = W_3 g	301	299	
4	Aggregate Impact value = percent fines	22.02	22.94	
	100* (W_2/W_1)%			22.48

Comments:

→ Maximum allowable Aggregate Impact value for Semi Dense Bituminous Concrete is 27%

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Aggregate Impact Value

IS: 2386 Part IV

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of the Work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Source / Location	Hot Mix Plant, Bangalore
Type of Mix	Semi Dense Bituminous Concrete
Date of Testing	21.07.2014

Sl No.	Details	Trial No. 1	Trial No. 2	Average
1	Total weight of aggregate sample filling the cylindrical measure = W_1 g	382	385	
2	Weight of agregate passing 2.36 mm sieve after the test = W_2 g	83	86	
3	Weight of aggregate retained 2.36 mm sieve after the test = W_3 g	299	299	
4	Aggregate Impact value = percent fines 100* (W_2/W_1)%	21.73	22.34	22.03

Comments:

→ Maximum allowable Aggregate Impact value for Semi Dense Bituminous Concrete is 27%

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DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of Work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Technical Reference	IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	Semi Dense Bituminous Concrete
Date of Testing	21.07.2014

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Result : Flakiness Index = **11.28%**

Elongation Index = **13.53%**

Result : Combined Flakiness & Elongation index **24.81%**

Comments:

→ Maximum allowable Flakiness & Elongation Index for Semi Dense Bituminous Concrete is 30%

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DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of Work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Technical Reference	IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	Semi Dense Bituminous Concrete
Date of Testing	21.07.2014

Result : Flakiness Index = **11.46%**

Elongation Index = **13.71%**

Result : Combined Flakiness & Elongation index **25.17%**

Comments:

→ Maximum allowable Flakiness & Elongation Index for Semi Dense Bituminous Concrete is 30%

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/Stripping/2014-15 23.07.2014

Stripping Value of Road Aggregates (Static Immersion Test)

IS: 6241

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of the work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Type of Mix	Semi Dense Bituminous Concrete
Date of Testing	23.07.2014

Type of binder : 80/100
Percentage of binder used : 5.0% by wt.
Total weight of aggregate : 200 g
Total weight of binder : 10.0 g
Temperature of water-bath : 40° C

Observation Number	Stripping, Percentage	Average, Percentage	Average Retained Coating, %
1	2.5	2.73	97.27
2	2.8		
3	2.9		

Comments:

→ Minimum allowable Aggregate retained coating for Semi Dense Bituminous Concrete is 95%

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Job No.: CTCE/BBMP/W.No.07/SDBC/Sp_Wa/2014-15 23.07.2014

Specific Gravity And Water Absorption Test

IS: 2386 Part III

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of the Work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Type of Mix	Semi Dense Bituminous Concrete
Source / Location	Hotmix Plant, Bangalore
Date of Testing	23.07.2014

Sl. No.	Details	Notation	Test Number			Mean Value
			Test 1	Test 2	Test 3	
1	Weight of aggregate suspended in water with the basket	W_1 g	2022	2023	2026	
2	Weight of basket suspended in water	W_2 g	750	750	750	
3	Weight of saturated aggregate in water	$(W_1 - W_2) = W_s$ g	1272	1273	1276	
4	Weight of saturated surface dry aggregate in air	W_3 g	2041	2043	2046	
5	Weight of water equal to the volume of the aggregate	$(W_3 - W_S)$ g	769	770	770	
6	Weight of oven dried aggregate	W_4 g	2025	2023	2028	
7	Specific Gravity	$W_4/(W_3-W_S)$	2.633	2.627	2.634	2.631
8	Apparent Specific gravity	$W_4/(W_4-W_S)$	2.689	2.697	2.697	2.694
9	Water Absorption	$((W_3-W_4)*100)/W_4$	0.79%	0.99%	0.89%	0.89%

Comments:

→ Maximum allowable Aggregate Water absorption value for Semi Dense Bituminous Concrete is 2%

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/Bit/2014-15 23.07.2014

BITUMEN CONTENT DETERMINATION OF SEMI DENSE BITUMINOUS CONCRETE MIX

AASHTO T 164

CLIENT	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
AGENCY	**Technical Manager (West),** KRIDL, Bangalore.
NAME OF THE WORK	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
REFERENCE	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
SAMPLE I/D	Roads in Kallappa, Munagurappa and Hoysala Layout Ward No.07, BBMP, Bangalore.
DATE OF TESTING	23.07.2014

BITUMEN CONTENT DETERMINATION

Description	Trail 1	Trail 2
1. Weight of Mixture before Test, g	500	500
2. Weight of Mixture after Test, g	473	479.5
3. Weight of Asphalt and Mineral matter Extracted, g	-	-
4. Weight of Mineral Matter, g.	-	-
5. Weight of Ash, g		
6. Weight of Bitumen Extracted, g. (corrected)	27	20.50
7. Bitumen content in %	5.40	4.10
8. Average	**4.75**	

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/Bit/2014-15 23.07.2014

BITUMEN CONTENT GRADATION DETERMINATION OF SEMI DENSE BITUMINOUS CONCRETE MIX

AASHTO T 30

CLIENT	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
AGENCY	**Technical Manager (West),** KRIDL, Bangalore.
NAME OF THE WORK	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
REFERENCE	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
SAMPLE I/D	Roads in Kallappa, Munagurappa and Hoysala Layout Ward No.07, BBMP, Bangalore.
DATE OF TESTING	23.07.2014

GRADATION AFTER EXTRACTION

Sieve Size in mm	Trail 1				Specified Limits as per MORTH specification table 500-15 (Grading-2)
	Weight Retained, gm	% Retained	%Cummulative Retained	% Passing	
13.2	0	0	0	100	100
9.5	26.31	5.56	5.56	94.44	90-100
4.75	262.1	55.41	60.97	39.03	35-51
2.36	56.43	11.93	72.90	27.10	24-39
1.18	38.75	8.19	81.10	18.90	15-30
0.3	26.95	5.70	86.79	13.21	9-19
0.075	27.12	5.73	92.53	7.47	3-8

Sieve Size in mm	Trail 2				Specified Limits as per MORTH specification table 500-15 (Grading-2)
	Weight Retained, gm	% Retained	%Cummulative Retained	% Passing	
13.2	0	0	0	100	100
9.5	36.12	7.53	7.53	92.47	90-100
4.75	262.1	54.66	62.19	37.81	35-51
2.36	52.63	10.98	73.17	26.83	24-39
1.18	36.52	7.62	80.79	19.21	15-30
0.3	30.79	6.42	87.21	12.79	9-19
0.075	27.55	5.75	92.95	7.05	3-8

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/Bitumen/2014-15 23.07.2014

BITUMEN DETERMINATION OF SEMI DENSE BITUMINOUS CONCRETE MIX

AS per IRC : SP : 11 - 1984

CLIENT	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
AGENCY	**Technical Manager (West),** KRIDL, Bangalore.
NAME OF THE WORK	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
REFERENCE	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
SAMPLE I/D	Roads in Kallappa Layout, Ward No. 07
DATE OF TESTING	23.07.2014

BITUMEN CONTENT DETERMINATION

Description	Trail 1	Trail 2
1. Weight of Mixture before Test, g	500	500
2. Weight of Mixture after Test, g	474.5	475.5
3. Weight of Asphalt and Mineral matter Extracted, g	-	-
4. Weight of Mineral Matter, g.	-	-
5. Weight of Ash, g		
6. Weight of Bitumen Extracted, g. (corrected)	25.5	24.50
7. Bitumen content in %	5.10	4.90
8. Average	**5.00**	

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/Gradation/2014-15 23.07.2014

GRADATION DETERMINATION OF SEMI DENSE BITUMINOUS CONCRETE MIX

As per IS : 2386 and IRC : SP : 11 - 1984

CLIENT	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
AGENCY	**Technical Manager (West),** KRIDL, Bangalore.
NAME OF THE WORK	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
REFERENCE	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
SAMPLE I/D	Roads in Kallappa Layout, Ward No. 07
DATE OF TESTING	23.07.2014

GRADATION AFTER EXTRACTION

Sieve Size in mm	Trail 1				Specified Limits as per MORTH specification table 500-15 (Grading-2)
	Weight Retained, gm	% Retained	%Cummulative Retained	% Passing	
13.2	0	0	0	100	100
9.5	23.89	5.03	5.03	94.97	90-100
4.75	247.65	52.19	57.23	42.77	35-51
2.36	55.38	11.67	68.90	31.10	24-39
1.18	52.13	10.99	79.88	20.12	15-30
0.3	27.95	5.89	85.77	14.23	9-19
0.075	38.16	8.04	93.82	6.18	3-8

Sieve Size in mm	Trail 2				Specified Limits as per MORTH specification table 500-15 (Grading-2)
	Weight Retained, gm	% Retained	%Cummulative Retained	% Passing	
13.2	0	0	0	100	100
9.5	34.15	7.18	7.18	92.82	90-100
4.75	258.63	54.39	61.57	38.43	35-51
2.36	53.47	11.25	72.82	27.18	24-39
1.18	41.89	8.81	81.63	18.37	15-30
0.3	26.38	5.55	87.18	12.82	9-19
0.075	28.57	6.01	93.18	6.82	3-8

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/AGG/2014-15 23.07.2014

Aggregate Gradation Test

IS : 2386 Part I

Client	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	**Technical Manager (West),** KRIDL, Bangalore.
Name of the Work	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Sample I / D	Hot Mix Plant, Bangalore
Type of Mix	Semi Dense Bituminous Concrete (SDBC)
Date of Testing	23.07.2014

Total Weight of Sample: **5650** gm

SIEVE SIZE, mm	Weight Retained, gm	% Retained	Cummulative % Retained	% Passing	Grade-II As per MORTH	Remarks
13.2	0	0.0	0	100	100	Gradation satisfies Grade II MORTH specification
9.5	453	8.0	8.02	91.98	90-100	
4.75	2974	52.6	60.65	39.35	35-51	
2.36	723	12.8	73.45	26.55	24-39	
1.18	451	8.0	81.43	18.57	15-30	
0.3	346	6.1	87.56	12.44	9-19	
0.075	325	5.8	93.31	6.69	3-8	

Total Weight of Sample: **5600** gm

SIEVE SIZE, mm	Weight Retained, gm	% Retained	Cummulative % Retained	% Passing	Grade-II As per MORTH	Remarks
13.2	0	0.0	0	100	100	Gradation satisfies Grade II MORTH specification
9.5	386	6.9	6.89	93.11	90-100	
4.75	2962	52.9	59.79	40.21	35-51	
2.36	629	11.2	71.02	28.98	24-39	
1.18	434	7.8	78.77	21.23	15-30	
0.3	345	6.2	84.93	15.07	9-19	
0.075	495	8.8	93.77	6.23	3-8	

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Job No.: CTCE/BBMP/W.No.07/KRIDL/SDBC/Stability/2014-15 23.07.2014

TEST REPORT ON STABILITY OF MIX

Client	:	**Asst. Executive Engineer,** Kodigehalli Sub Division, BBMP, Bangalore.
Agency	:	**Technical Manager (West),** KRIDL, Bangalore.
Name of the work	:	Improvements of Roads at Ward No.07, Byatarayanapura in Kallappa, Munagurappa and Hoysala Layout, BBMP, Bangalore.
Reference	:	AEE/(KOD.SUB.DIV)/67/A/2014-15 Dated: 26.06.2014
Source of location	:	Hot mix Plant, Bangalore
Type of Mix	:	Semi Dense Bituminous Concrete
Date of Testing	:	23.07.2014

The results of the tests conducted on the bituminous mix sample are as follows:

Sl. No	Description	Test Result 1	Test Result 2	Requirement as per MORTH (Table 500-16)
1	Marshal Stability, at 60° C, Kn	9.45	10.10	8.2 Kn (min)
2	Marshal flow at 60° C, mm	3.10	2.95	2 – 4
3	Percent air voids	4.70	3.60	3 – 5
4	Percent voids in mineral aggregates (VMA %)	13.25	14.85	13 - 15
5	Percent voids filled with Bitumen (VFB %)	72.50	73.15	65 – 78
6	Density, g/cc	2.27	2.28	---

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